

Appl. No. 11/031,039

Amendments to the Claims:

This listing of claims will replace all prior versions, and listings, of claims in the application:

Listing of Claims:

Claim 1. (Currently Amended) A planar waveguide spectrometer apparatus comprising a microfluidic channel or compartment microfabricated integrally with a planar waveguide or hybrid assembled with the planar waveguide and optically coupled thereto, wherein the planar waveguide comprises:

a thin planar substrate made of a transparent waveguiding optical material, having the following features integrally formed thereon:

a planar multilayer of differing refractive indices to allow guiding of light in a direction disallowing diffusion of light perpendicular to the plane of the layers;

one or more input waveguides to further guide light radiation transversely from an input edge of the substrate disallowing diffusion of radiation in a direction along the multilayer plane and parallel to the input edge, said input waveguides to guide light a predetermined distance to a termination edge or image line;

a waveguide-based spectrometer having diffractive elements and slab regions between the input waveguides, the diffractive elements and output waveguides, with an input region coincident to the termination edges of the input waveguides, the diffractive elements being adapted to separate a plurality of input wavelengths into separate focal spots along an image plane of desired curvature perpendicular to the optical guiding multilayer; and

one or more output waveguides similar to the input waveguides, said output waveguides beginning at the image plane of the spectrometer at positions suitable for capturing

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radiation at desired wavelengths, and guiding the radiation to an output edge perpendicular to the optical multilayer planes and coincident with an output plane of the termination points of the output waveguides; and

a detector array placed facing the output edge with detector elements following all or some of the output waveguides at their termination points,

wherein the microfluidic channel or compartment is microfabricated integrally with the thin planar substrate or hybrid assembled with the thin planar substrate and optically coupled thereto,

wherein multiple diffraction orders from the spectrometer are allowed to illuminate the output waveguides, and unwanted orders are eliminated on a waveguide-by-waveguide basis by means of lithographically defined scattering from resonant perturbations of the output waveguides or by filters added to the output waveguide paths.

Claim 2. (Cancelled)

Claim 3. (Currently Amended) The apparatus of claim 2 1 wherein the planar multilayer comprises at least two layers, with one layer, a guiding layer or core layer, in the midst of all layers having a refractive index exceeding the indices of adjacent layers.

Claim 4. (Currently Amended) The apparatus of claim 2 3 wherein structures giving transverse definition to the input and output waveguides comprise a pair of walls perpendicular to the plane of the optical layers, cutting through at least the guiding layer, and surrounded on either side by optical material of lower index than that of the guiding layer.

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Claim 5. (Currently Amended) The apparatus of claim 2 ~~3~~ wherein the spectrometer comprises a planar waveguide at both the input edge and the image plane, said planar waveguide extending to a reflective diffraction grating with grating facets constructed perpendicular to the guiding layer and intersecting the guiding layer.

Claim 6. (Original) The apparatus of claim 5 wherein the image plane is curved, with radius R, lying on a Rowland circle, and the centers of the grating facets lie in a curved plane of radius twice R.

Claim 7. (Currently Amended) The apparatus of claim 2 ~~1~~, wherein an optical fiber is aligned to an input waveguide at the input edge to deliver radiation at a plurality of wavelengths within a predetermined spectral range.

Claim 8. (Currently Amended) The apparatus of claim 2 ~~1~~ further comprising an electronic subsystem for collecting signals from the array for processing and correlation, and allowing the a processed signal to be interpreted for information about a system being studied using the radiation incident to the input edge of the device.

Claim 9. (Cancelled)

Claim 10. (Currently Amended) The apparatus of claim 2 ~~1~~ wherein the desired wavelengths are equispaced for continuous mapping or non-equispaced for the selective mapping of wavelengths.

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Claim 11. (Currently Amended) The apparatus of claim 2 1 optimized for detection of fluorescence from quantum dot fluorescent tags or fluorescent dyes.

Claim 12. (Currently Amended) The apparatus of claim 1 wherein the microfluidic channel or compartment comprises a fluorescence chamber coupled to the planar waveguide via ~~high numerical-aperture~~ optics.

Claim 13. (Currently Amended) The apparatus of claim 12 wherein the fluorescence chamber is either integrated with the planar waveguide either by means of passive alignment therewith or integrated monolithically with the planar waveguide.

Claim 14. (Original) The apparatus of claim 13, wherein the fluorescence chamber is designed as a standard microfluidics system, employing electro-osmotic flow or pressure induced flow.

Claim 15. (Currently Amended) Use of an apparatus according to claim 2 1 for DNA sequencing, bio imaging or other applications through wavelength detection of fluorescent markers, fluorescent dyes and quantum dots.

Claims 16 to 23. (Cancelled)